



THE PLANETS



MODEL WORLDS



My planet fetish began, as best I can recall, in third grade, at age eight—right around the time I learned that Earth had siblings in space, just as I had older brothers in high school and college. The presence of the neighboring worlds was a revelation at once specific and mysterious in 1955, for although each planet bore a name and held a place in the Sun's family, very little was known about any of them. Pluto and Mercury, like Paris and Moscow, only better, beckoned a childish imagination to ultra-exotic utopias.

The few sure facts about the planets suggested fantastic aberrations, ranging from unbearable extremes of temperature to the warping of time.

Since Mercury, for example, could circle the Sun in only 88 days, compared to the Earth's 365, then a year on Mercury would whiz by in barely three months, much the way "dog years" packed seven years of animal experience into the dog owner's one, and thereby accounted for the regrettably short lives of pets.

Every planet opened its own realm of possibility, its own version of reality. Venus purportedly hid lush swamps under its perpetual cloud cover, where oceans of oil, or possibly soda water, bathed rain forests filled with yellow and orange plant life. And these opinions issued from serious scientists, not comic books or sensational fiction.

The limitless strangeness of the planets contrasted sharply with their small census. In fact, their nine-ness helped define them as a group. Ordinary entities came in pairs or dozens, or quantities ending in a five or a zero, but planets numbered nine and nine only. Nine, odd as outer space itself, could nevertheless be counted on the fingers. Compared to the chore of memorizing forty-eight state capitals or significant dates in the history of New York City, the planets promised mastery in an evening. Any child who committed the planets' names to memory with the help of an appealing nonsense-sentence

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mnemonic—"My very educated mother just served us nine pies"—simultaneously gained their proper progression outward from the Sun: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto.

The manageable sum of planets made them seem collectible, and motivated me to arrange them in a shoe-box diorama for the science fair. I gathered marbles, jacks balls, Ping-Pong balls, and the pink rubber Spaldeens we girls bounced for hours on the sidewalk, then I painted them with tempera, and hung them on pipe cleaners and string. My model (more like a doll house than a scientific demonstration) failed to give any real sense of the planets' relative sizes or the enormous distances between them. By rights I should have used a basketball for Jupiter, to show how it dwarfed all the others, and I should have mounted everything in a giant carton from a washing machine or a refrigerator, the better to approximate the Solar System's grandiose dimensions.

Fortunately my crude diorama, produced with a complete lack of artistic skill, did not kill my beautiful visions of Saturn suspended in the perfect symmetry of its spinning rings, or the mutating patterns on the Martian landscape, which were

Overview

attributed, in scientific reports of the 1950s, to seasonal cycles of vegetation.

After the science fair, my class staged a planets play. I got the part of "Lonely Star" because the script called for that character to wear a red cape, and I had one, left over from a Halloween costume. As Lonely Star, I soliloquized the Sun's wish for companionship, which the planet-actors granted by joining up with me, each in a speech admitting his own peculiarities. The play's most memorable performances were delivered by "Saturn," who twirled two Hula-hoops while reciting her lines, and "The Earth," plump and self-conscious, yet forced to announce matter-of-factly, "I am twenty-four thousand miles around my middle." Thus was the statistic of our Earth's circumference indelibly impressed upon me. (Note that we always said "the earth," in those days. "The earth" did not become "Earth" until after I came of age and the Moon changed from a nightlight to a destination.)

My role as Lonely Star helped me appreciate the Sun's relationship to the planets as parent and guide. Not for nothing is our part of the universe called the "Solar System," in which each planet's individual makeup and traits are shaped in large measure by proximity to the Sun.

I had omitted the Sun from my diorama because I hadn't understood its power, and besides, it would have posed an impossible problem of scale.* Another reason for leaving out the Sun, and likewise the Moon, was the bright familiarity of both objects, which seemed to render them regular components of the Earth's atmosphere, whereas the planets were glimpsed only occasionally (either before bedtime or in a still-dark, early-morning sky), and therefore more highly prized.

On our class trip to the Hayden Planetarium, we city kids saw an idealized night sky, liberated from the glare of traffic signals and neon lights. We watched the planets chase each other around the heavens of the dome. We tested the relative strength of gravity with trick scales that told how much we'd weigh on Jupiter (four hundred pounds and more for a normal-sized teacher) or Mars (featherweights all). And we gawked at the sight of the fifteen-ton meteorite that had fallen from out of the blue over Oregon's Willamette Valley,

*In his ingenious pamphlet, "The Thousand-Yard Model, or, The Earth as a Peppercorn," Guy Ottewell guides the construction of a scale model Solar System using a bowling ball for the Sun. The eight-thousand-mile-wide Earth, here reduced to a peppercorn, takes its rightful place seventy-eight feet (!) from the bowling ball.

posing a threat to human safety that few of us had thought to fear.

The Willamette meteorite (still on permanent display at what is now the Rose Center for Earth and Space) was said to be, incredibly, the iron-nickel core of an ancient planet once in orbit around the Sun. That world had shattered somehow, several billion years back, setting its fragments adrift in space. Chance had nudged this particular piece toward the earth, where it hurtled down to the Oregon ground at tremendous speed, burning up from the heat of friction, and hitting the valley floor with the impact of an atom bomb. Later, as the meteorite lay still over eons, the acidic rains of the Pacific northwest chewed large holes in its charred and rusted hulk.

Here was a primal scene to upset my innocent planet ideas. This dark, evil invader had no doubt consorted in space with hordes of other stray rocks and metal chunks that might strike the earth at any moment. My Solar System home, till that moment a paragon of clockwork regularity, had turned into a disorderly, dangerous place.

The launch of *Sputnik* in 1957, when I was ten, scared me to death. As a demonstration of foreign military strength, it gave new meaning to the

school-wide air raid drills in which we crouched under our desks for pretended safety, our backs to the windows. Clearly we still had more to dread from angry fellow humans than from wayward space rocks.

All through my teens and twenties, as the country realized the young president's dream of a rocket to the Moon, clandestine rockets in missile silos kept collective nightmares alive. But by the time the Apollo astronauts brought back their last batch of Moon rocks in December 1972, peaceful, hopeful spaceships had landed also on Venus and Mars, and another, the U.S. *Pioneer 10*, was en route to a Jupiter flyby. Throughout the 1970s and '80s, hardly a year passed without an unmanned excursion to another planet. Images radioed home to Earth by robot explorers painted detail upon detail on the planets' long-blank faces. Whole new entities came to light, too, as spacecraft encountered literally dozens of new moons at Jupiter, Saturn, Uranus, and Neptune, as well as multiple rings around all four of those planets.

Even though Pluto remained unexplored, deemed too distant and too difficult to visit, its own unexpected moon was discovered accidentally in 1978, through careful analysis of photographs

taken by ground-based telescopes. Had my daughter, born in 1981, attempted her own diorama of the revised and expanded Solar System when she turned eight, she would have needed handfuls of jellybeans and jawbreakers to model the many recent additions. My son, three years her junior, might have opted to model his on our home computer.

Despite the increased population of the Solar System, its planets stayed stable at nine, at least through 1992. That year, a small, dark body, independent of Pluto, was detected on the Solar System's periphery. Similar discoveries soon followed, until the total number of diminutive outliers grew to seven hundred over the ensuing decade. The abundance of mini-worlds made some astronomers wonder whether Pluto should continue to be regarded as a planet, or reclassified as the largest of the "trans-Neptunian objects." (The Rose Center has already excluded Pluto from the planetary roll call.)

In 1995, only two years after the first of Pluto's numerous neighbors was found, something even more remarkable came to light. It was a bona fide new planet—of another star. Astronomers had

long suspected that stars other than the Sun might have their own planetary systems, and now the first one had surfaced at 51 Pegasi, in the constellation of the flying horse. Within months, other "exoplanets"—as the newly discovered extra-solar planets were quickly dubbed—turned up at stars such as Upsilon Andromedae, 70 Virginis b, and PSR 1257+12. At least 160 additional exoplanets have since been identified, and refinements in discovery techniques promise to uncover many more in the near future. Indeed the number of planets in our Milky Way Galaxy alone may far exceed its complement of one hundred billion stars.

My old familiar Solar System, once considered unique, now stands as merely the first known example of a popular genre.

As yet, no exoplanets have been imaged directly through a telescope, so their discoverers are left to imagine what they look like. Only their sizes and orbital dynamics are known. Most of them rival giant Jupiter in heft, because large planets are easier to find than small ones. Indeed, the existence of exoplanets is deduced from their effect on their parent star: Either the star wobbles as it yields to the gravitational attraction of unseen companions,

or it periodically dims as its planets pass in front and impede its light. Small exoplanets, the size of Mars or Mercury, must also orbit distant suns, but, being too tiny to perturb a star, they elude detection from afar.

Already planetary scientists have appropriated the name “Jupiter” as a generic term, so that “a jupiter” means “a large exoplanet,” and the mass of an extremely large exoplanet may be quantified as “three jupiters” or four. In the same fashion, “an earth” has come to represent the most difficult, most desirable goal of today’s planet hunters, who are devising ways to probe the Galaxy for petite, fragile spheres in the favored shades of blue and green that hint at water and life.

Whatever daily concerns dominate our minds at the dawn of the present century, the ongoing discovery of extra-solar planetary systems defines our moment in history. And our own Solar System, rather than shrink in importance as one among many, proves the template for comprehending a plethora of other worlds.

Even as the planets reveal themselves to scientific investigation, and repeat themselves across the universe, they retain the emotional weight of

their long influence on our lives, and all that they have ever signified in Earth’s skies. Gods of old, and demons, too, they were once—they still are—the sources of an inspiring light, the wanderers of night, the far horizon of the landscape of home.